NASA STTR 2004 Phase I Solicitation

T6.01 Self-Healing Repair technologies

Lead Center: KSC

It is highly desirable to develop technologies for polymeric and composite materials that mimic the repair processes of biological systems. Much can be learned by relating the repair processes of biological systems to these inanimate materials, in particular, learning methods to initiate the self-healing processes. One example of inanimate self-healing is the repair process for composite materials, which uses the stress induced by a microfissure to rupture microcapsules of repair materials. In this system, a monomer is microencapsulated and then dispersed along with a catalyst. Once the microcapsules rupture, the monomer is polymerized by the dispersed catalyst and the microfissure is filled. Another approach might be to combine animate and inanimate systems in such a way that the repair of the inanimate material is done by the animate system. Applications for self-healing processes of inanimate materials can be found in areas were failures could result in catastrophic consequences. Examples of these are failure of structural members in spacecraft or aircraft; failure of electrical wire insulation materials used in spacecraft, aircraft, or buildings; or failure of polymers membranes used in critical separations in the space exploration or medical devices.

Proposals are sought for innovative technologies and technology concepts in the areas of self-healing and repairing of electrical wiring insulation, which is an area under ASTRA’s Advanced Technology Development (2.4.6). Wire insulation failure is considered a major problem on spacecraft and proposals should support concepts to develop self-healing technologies that have the ability to repair damaged Kapton, Teflon, or vinyl-type wire insulation. Of particular importance will be the methods needed to induce the self-repair process in wire insulation that has been manufactured. It is important to recognize the effect of the manufacturing process used to produce the insulated wire on the final product. These methods must produce a flexible water-tight seal over the damaged area. The physical and chemical properties of the final repair material should be similar to the initial insulating materials.